Stoller
Grand Junction Office established 1959

299-E25-17 (A6301)
Log Data Report

Borehole Information:

Borehole:	299-E25-17 (A6301)		Site:	216-A-37-1 Crib	
Coordinates (WA State Plane)		GWL (ft)[1]: 278.4		GWL Date:	3/03/2003
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
135,702.51 m	575,760.25 m	July 1976	207.236 m	300	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	0	unknown	8	unknown		151.9
Welded steel	1.9	6 5/8	6	0.3125	+1.9	301.9

The logging engineer measured the 6-in. casing stick up using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. The 6-in. casing thickness was calculated. There was no evidence of 8-in. casing at the ground surface as reported in Ledgerwood (1993). Surrounding the borehole stick up is a round 18-in. by 4-in. high surface seal of grout.

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS[3], and Chamness and Merz (1993). Zero reference is the top of the 6-in. casing. A reference point survey "X" is located at the top of the casing stick up.

Logging Equipment Information:

Logging System:	Gamma 3E (RLS-1)		Type: 70% HPGe
Calibration Date:	10/2002	Calibration Reference:	GJO-2002-386-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4/Repeat	
Date	3/03/03	3/04/03	3/05/03	3/05/03	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	35.0	160.0	290.0	185.0	
Finish Depth (ft)	2.0	34.0	145.0	155.0	
Count Time (sec)	150	150	100	100	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	N/A[4]	N/A	N/A	N/A	

Log Run	1	2	3	4/Repeat	
Pre-Verification	CE161CAB	CE181CAB	CE191CAB	CE191CAB	
Start File	CE171000	CE181000	CE191000	CE191146	
Finish File	CE1710033	CE181126	CE191145	CE191176	
Post-Verification	CE171CAA	CE181CAA	CE191CAA	CE191CAA	
Depth Return Error (in.)	-0.5	-0.5	N/A	0	
Comments	Fine-gain adjustment before logging began and after file -026.	Fine-gain adjustment before logging began.	Fine-gain adjustment before logging began.	Repeat section. No fine-gain adjustment.	

Logging Operation Notes:

Zero reference was top of the 6-in. casing. Logging was performed without the centralizer on the sonde. The count time of 150 s was used in the double cased portion of the borehole. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. During SGLS logging, fine-gain adjustments were needed to maintain the 1460-keV (^{40}K) photopeak at the specified channel.

Analysis Notes:

Analyst:	Sobczyk	Date:	03/17/03	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra were all within the control limits established on 12/05/2002, except for spectrum CE191CAA. Post-run verification spectrum CE191CAA was slightly above the value for the 1461 peak counts per second (cps). The peak counts per second at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 5 percent lower and 2 percent higher at the end of the day. Examinations of spectra indicate that the detector functioned normally during all of the logging runs, and the spectra are accepted.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G3EOct02.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 6-in. casing. On the basis of Ledgerwood (1993) and the gross gamma response, the casing configuration was assumed to be one string of 6-in. surface casing to total depth (301.9 ft) and one string of 8-in. casing to 151.9 ft. Casing correction factors were calculated assuming a total casing thickness of 0.635 in. from 0 to 151.9 ft and 0.3125 in. from 151.9 ft to 290 ft. The casing correction factor was calculated assuming a 6-in. casing thickness of 0.3125 in. and an 8-in. casing thickness of 0.322 in. The 6-in. casing thickness is based upon the field measurement, and the 8-in. casing thickness of 0.322 in. is the published value for ASTM schedule-40 steel pipe (a commonly used casing material at Hanford). Where more than one casing exists at a depth, the casing correction is additive (e.g., 0.322 in. + 0.3125 in. = 0.635 in. would be the combined thickness for the 6-in. and 8-in. casings). A water correction was applied to the data below 278.4 ft. Dead time corrections were not applied since dead time was not greater than 18 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included.

For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it is less affected by the presence of radon gas inside the casing.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected at log depths of 2, 63, 118, 122, 203, and 211 ft with concentrations near the MDL (0.2 pCi/g). After examination of the spectra, it was determined that there is no evidence of a photopeak at 662 keV. The reported peaks are probably the result of statistical fluctuation.

Recognizable changes in the KUT logs occurred in this borehole. However, the changes above 152 ft are more indicative of the well completion materials than the surrounding formation. For example, the 40-cps increase in total gamma at 20 ft coincides with the depth of the surface seal of cement grout. The annulus between the 6-in. and 8-in. casings was perforated between 20 and 127 ft and grouted with bentonite and cement. The ^{40}K log shows significant changes at 220 and 256 ft. The 4-pCi/g decrease in ^{40}K concentrations at 220 ft corresponds with a transition to coarser grained sediments reported in Ledgerwood (1993).

The behavior of the ^{238}U log suggests that radon may be present inside the borehole casing. Determination of ^{238}U is based on measurement of gamma activity at 609 and/or 1764 keV associated with ^{214}Bi, under the assumption of secular equilibrium in the decay chain. However, ^{214}Bi is also a short-term daughter of ^{222}Rn. When radon is present, ^{214}Bi will tend to “plate” onto the casing wall and will quickly reach equilibrium with ^{222}Rn. Because the additional ^{214}Bi resulting from radon is on the inside of the casing, the effect of the casing correction is to amplify the 609 photopeak relative to the 1764 photopeak. (The magnitude of the casing correction factor decreases with increasing energy, but gamma rays originating inside the casing are not attenuated.) This effect is observed in log run 2 (160 to 34 ft). The effects of radon appear to be minimal in log runs 3 (290 to 145 ft) and 4 (185 to 155 ft). The reason for variations in radon content between log runs on successive days is not known. Variations in radon content in boreholes are probably related to variations in surface weather conditions. Radon daughters such as ^{214}Bi may also “plate” onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb.

The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

The plots of the repeat logs demonstrate good repeatability of the SGLS data for the natural radionuclides (609, 1461, 1764, and 2614 keV).

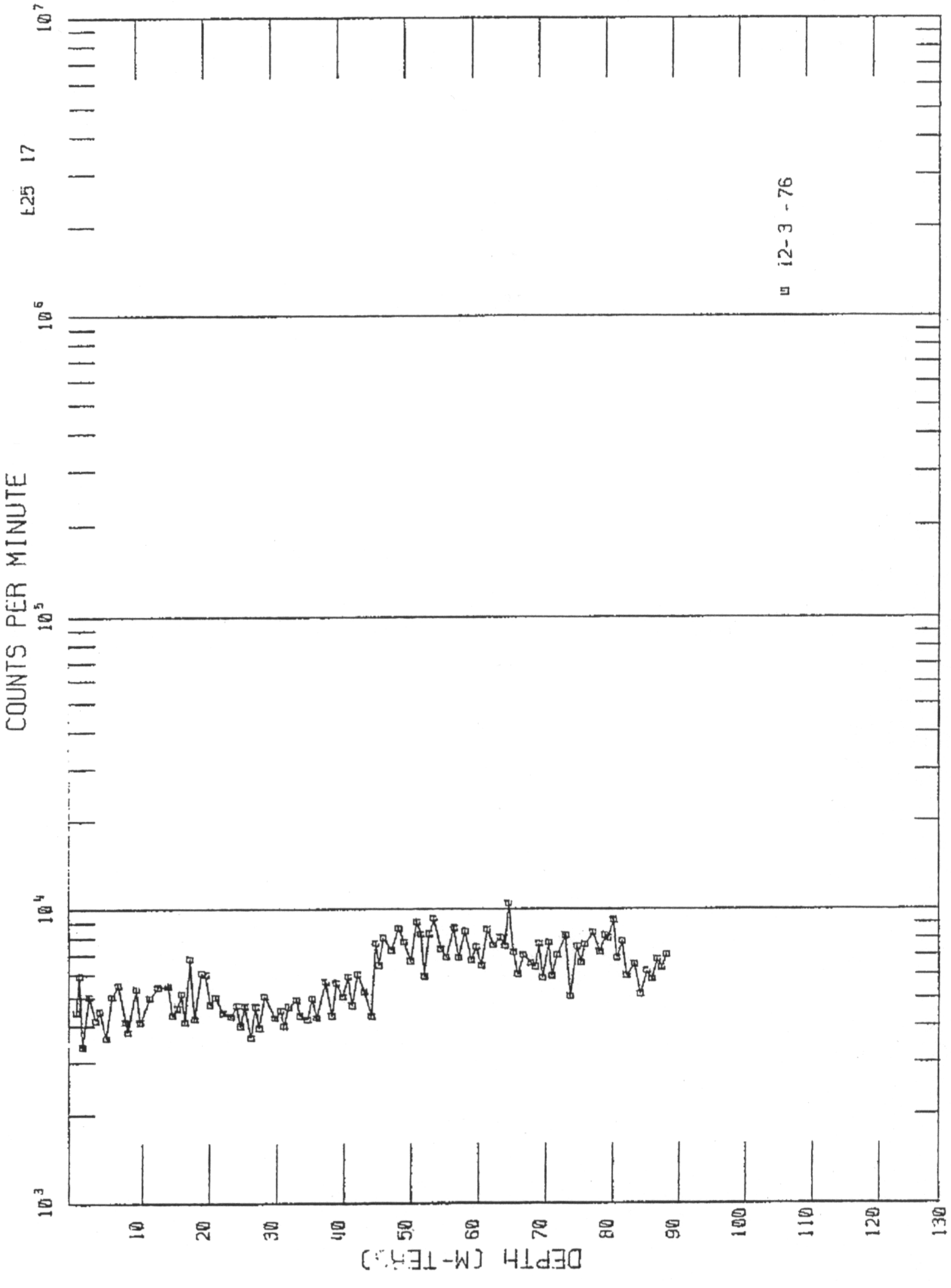
The gross gamma log from Additon et al. (1977) (attached) indicates that the sediments surrounding this borehole contained only background amounts of gamma radiation in 1976. The SGLS measured only scattered statistical hits of ^{137}Cs.

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Well*s, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

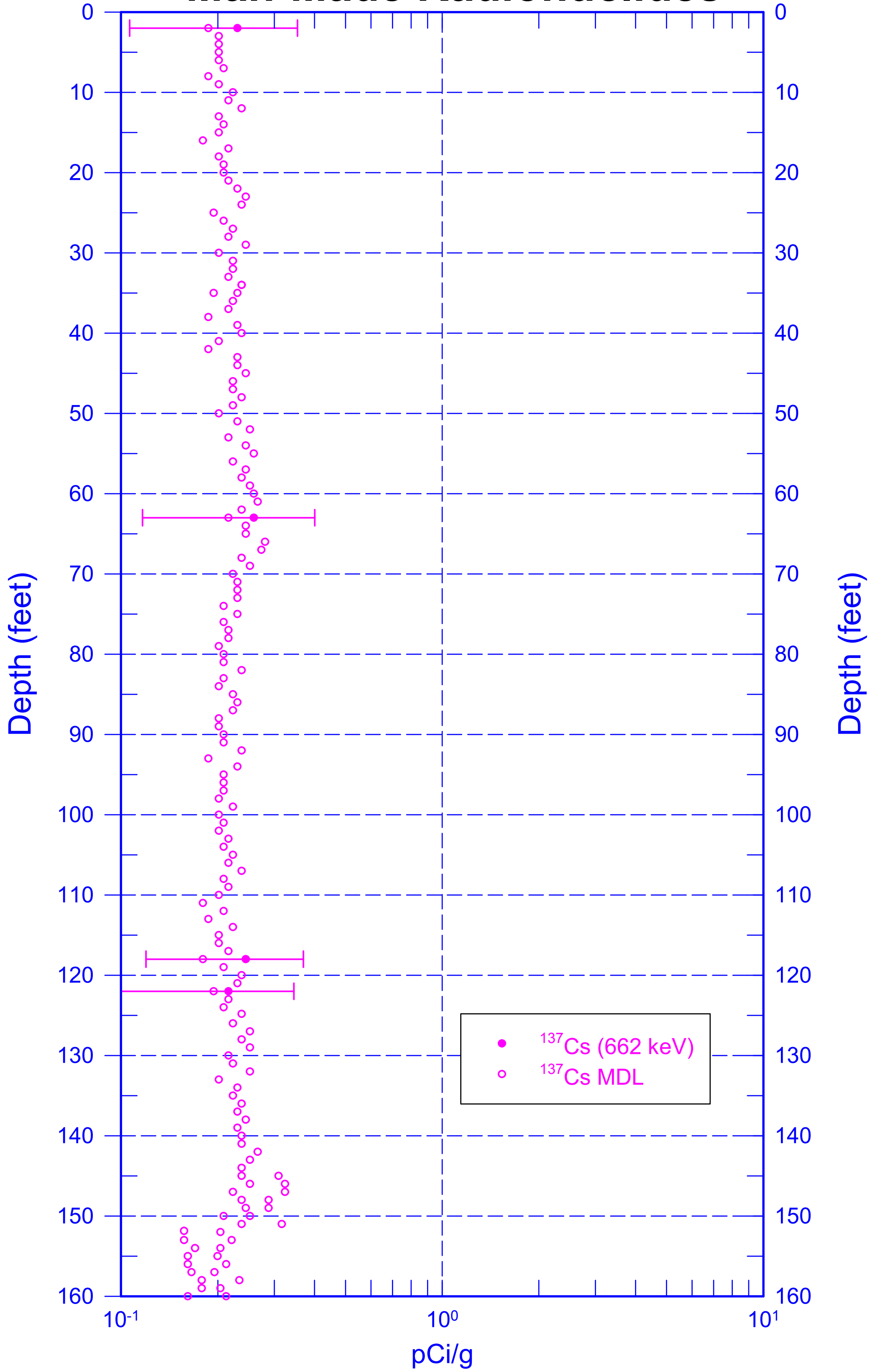
[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] N/A – not applicable



from Additon et al. (1978)

Scintillation Probe Profile for Borehole 299-E25-17, Logged on 12/3/76

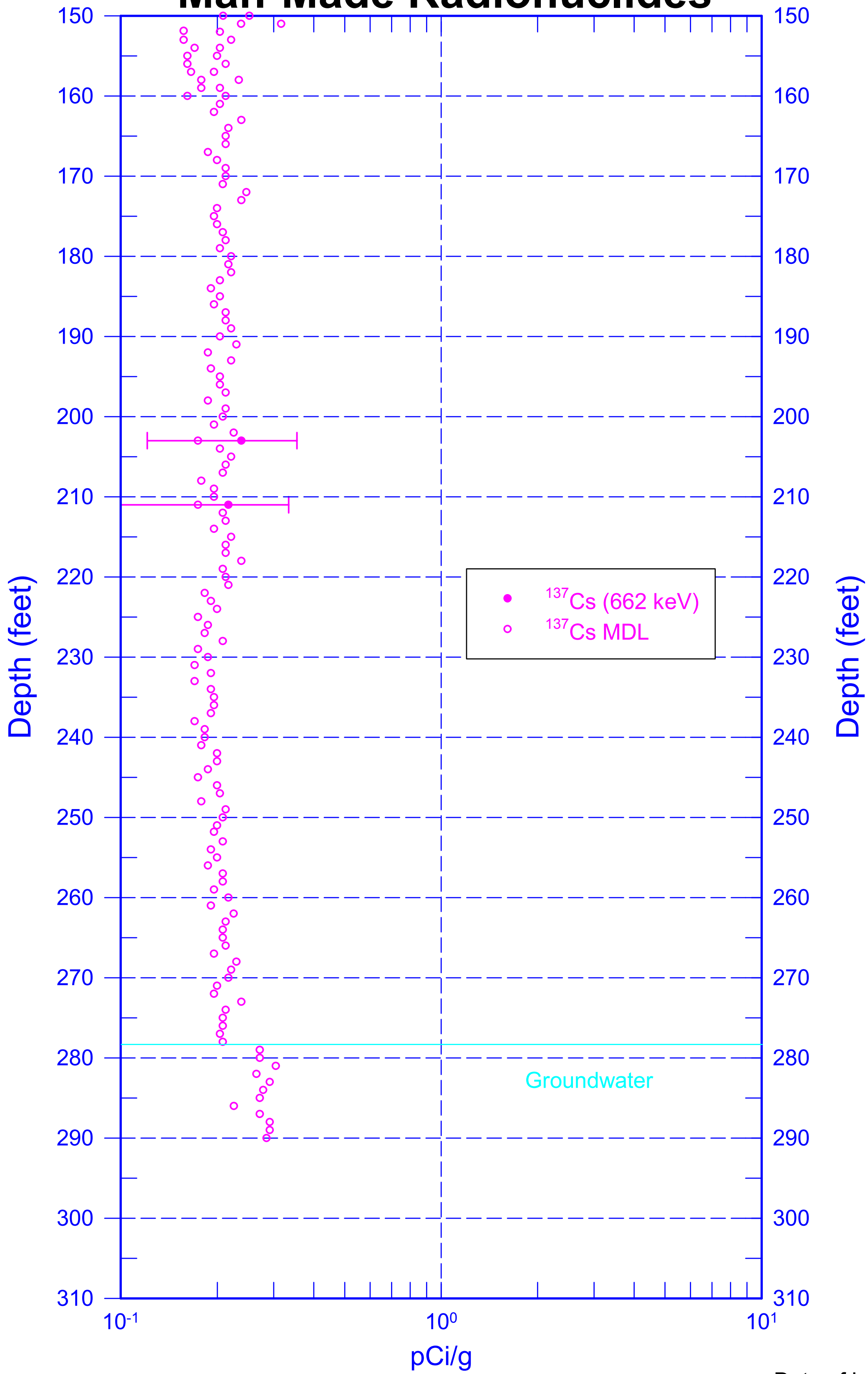
299-E25-17 (A6301)
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
3/05/2003

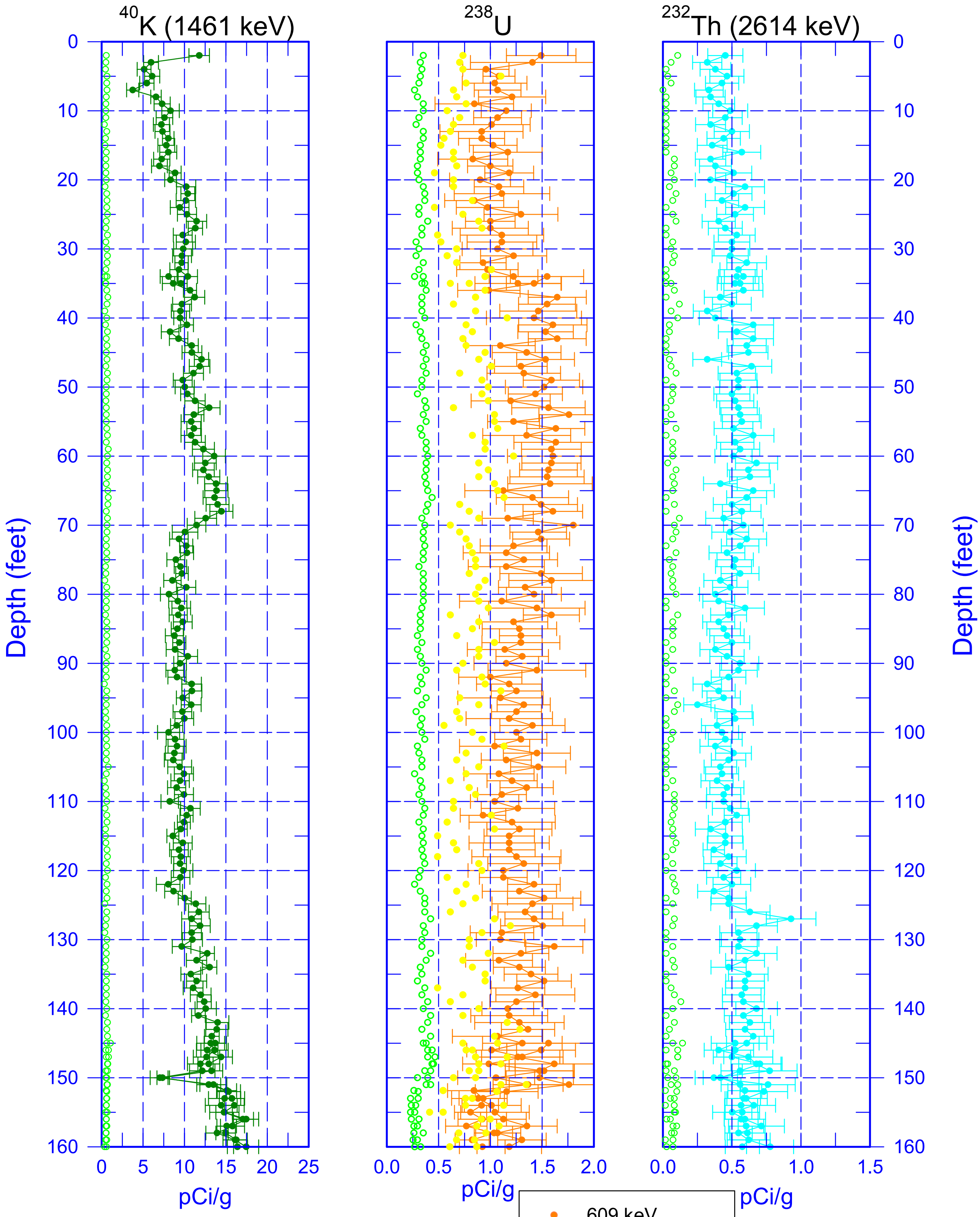
299-E25-17 (A6301)
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
3/05/2003

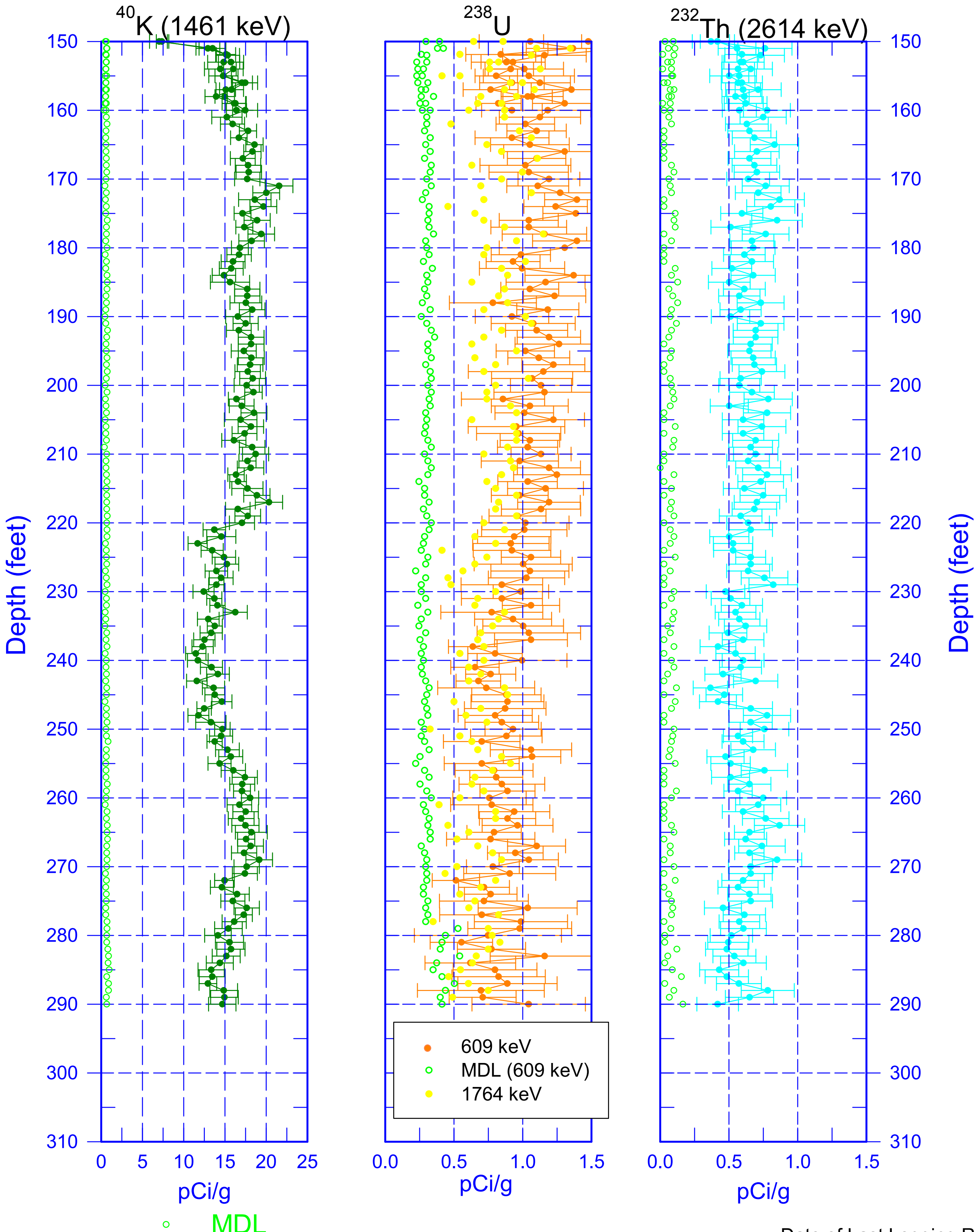
299-E25-17 (A6301)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
3/5/2003

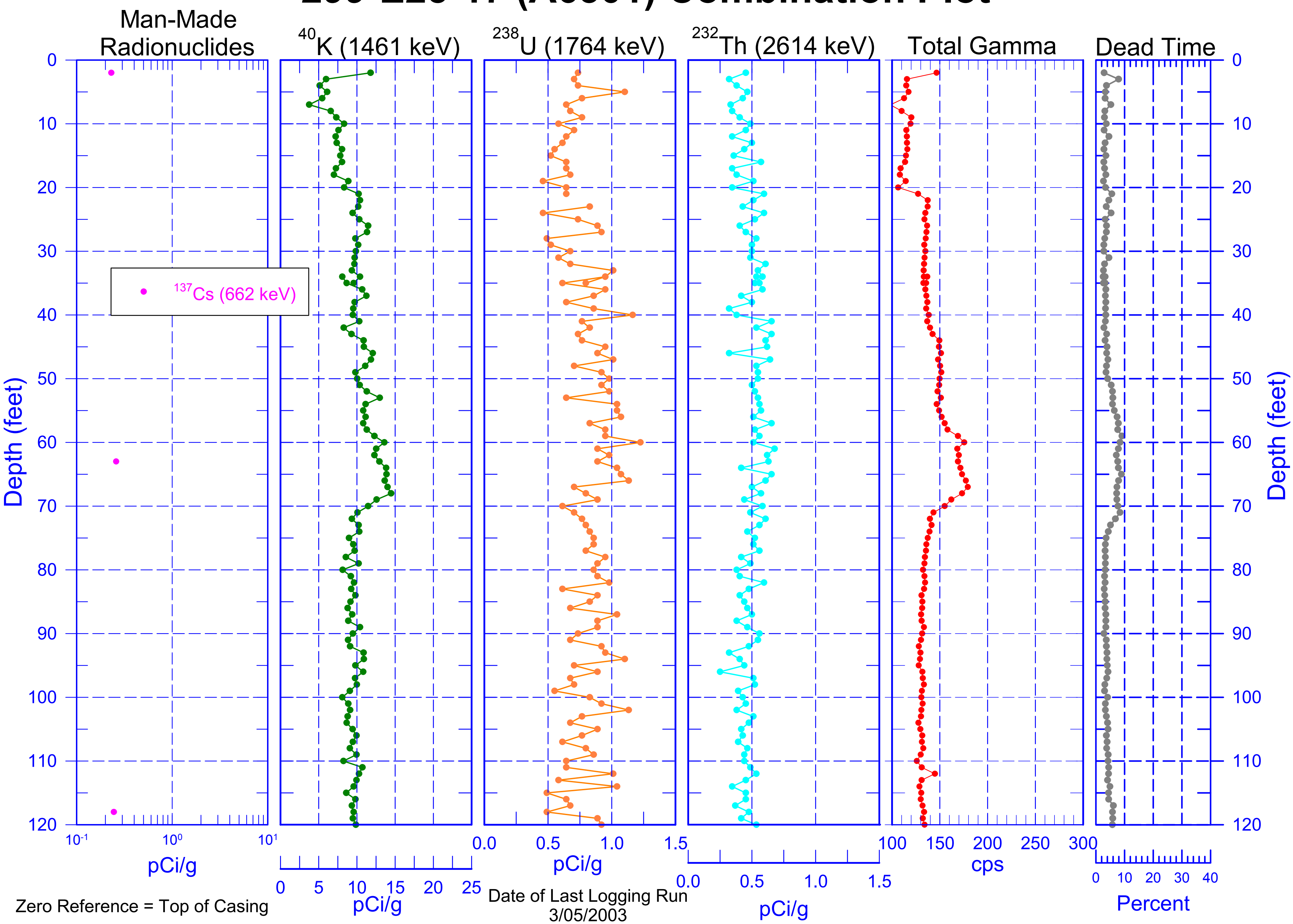
299-E25-17 (A6301)
Natural Gamma Logs



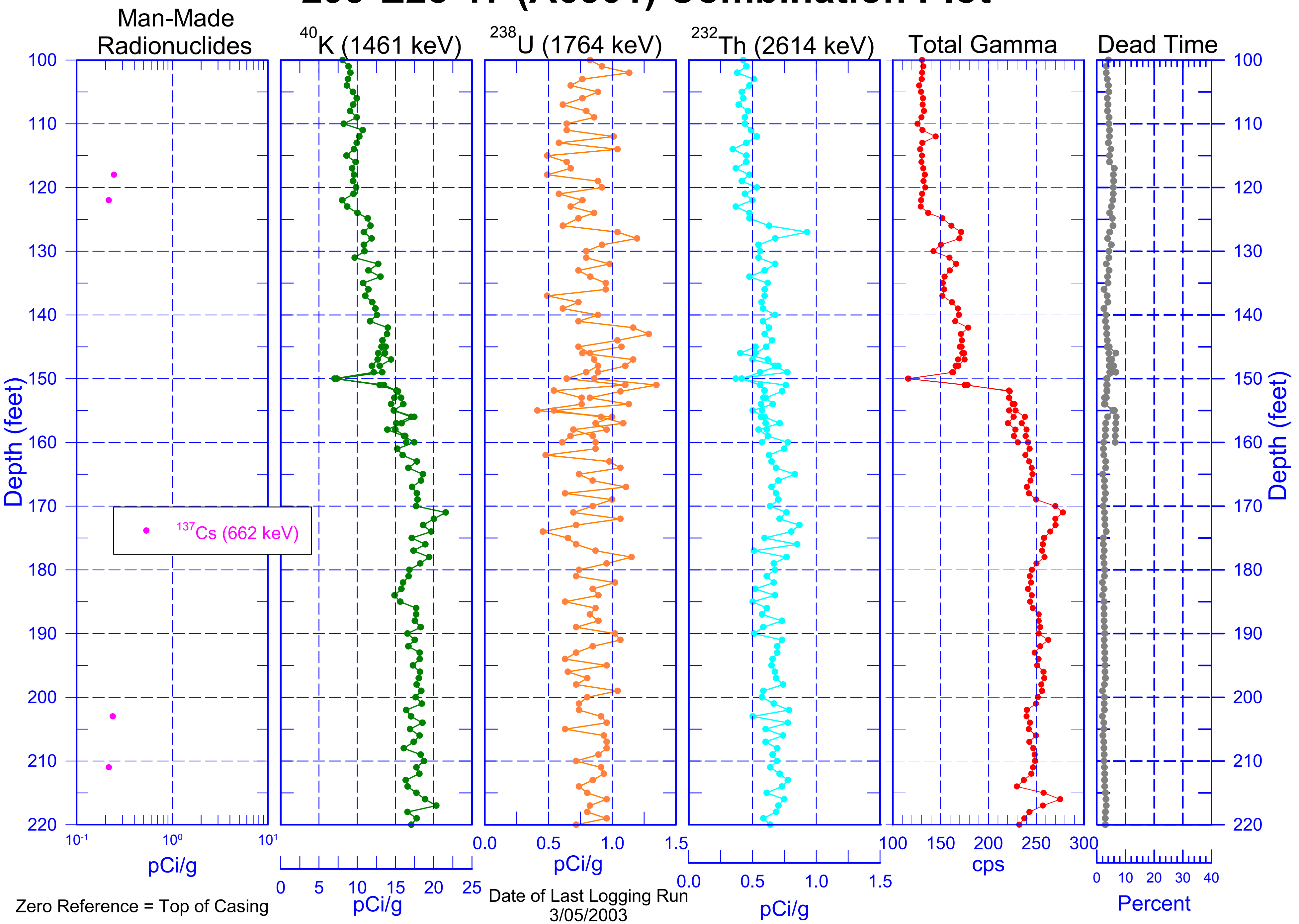
Zero Reference = Top of Casing

Date of Last Logging Run
3/5/2003

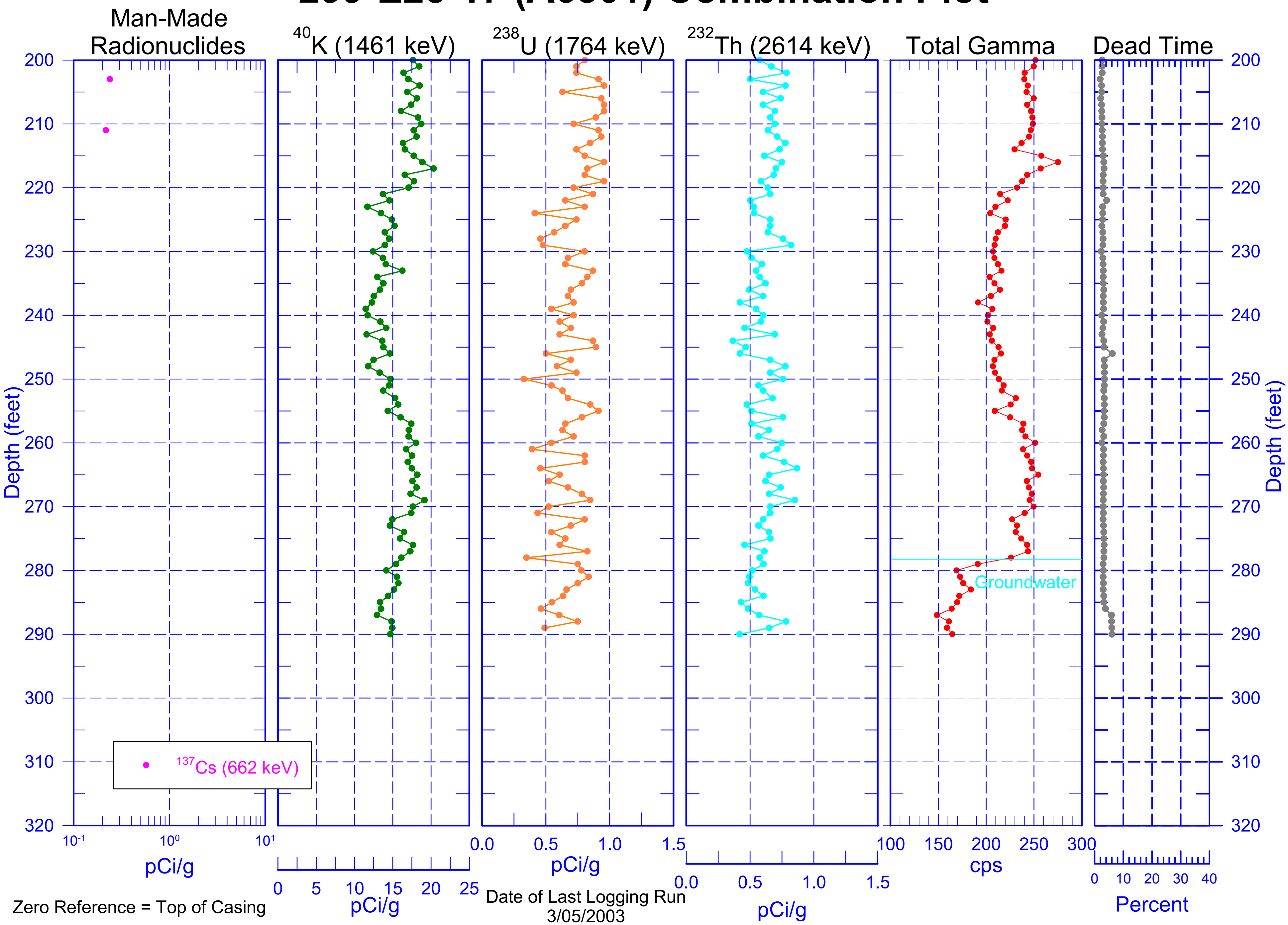
299-E25-17 (A6301) Combination Plot



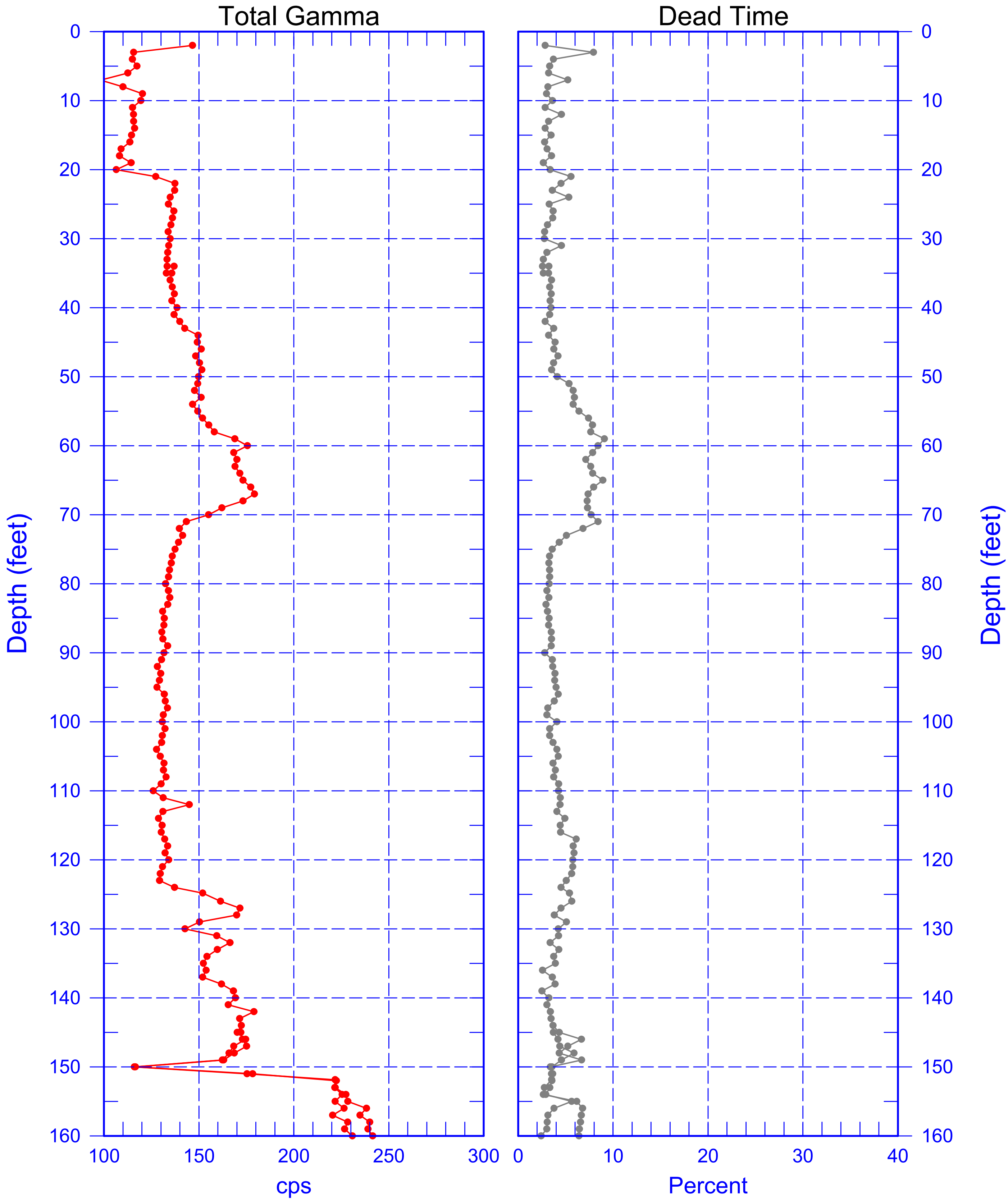
299-E25-17 (A6301) Combination Plot



299-E25-17 (A6301) Combination Plot



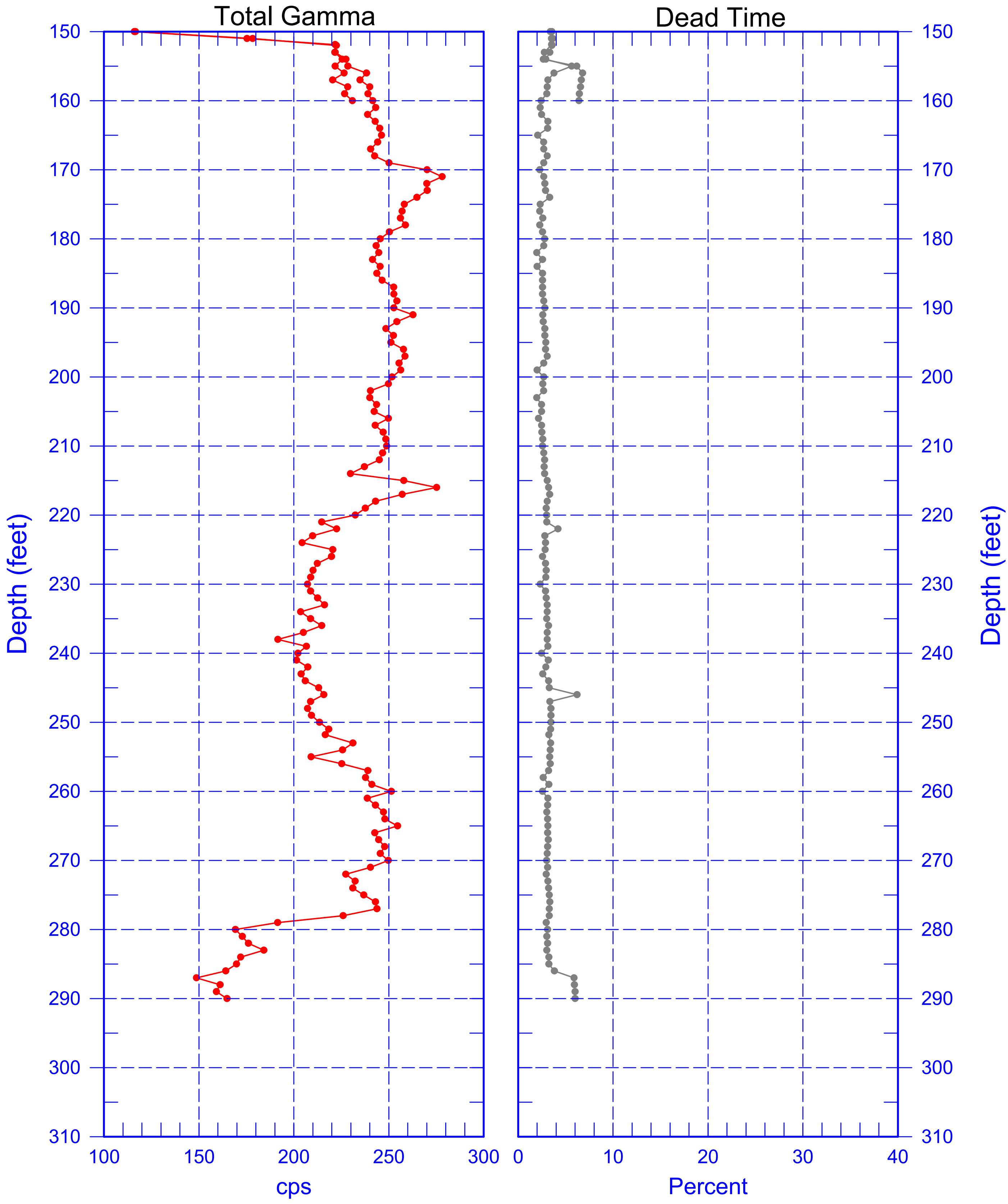
299-E25-17 (A6301)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
3/5/2003

299-E25-17 (A6301)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
3/3/2003

299-E25-17 (A6301)

Rerun of Natural Gamma Logs (185.0 to 155.0 ft)